

UNITED STATES DEPARTMENT OF AGRICULTURE

Soil Survey  
of  
Sherman County, Nebraska

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In cooperation with the University of Nebraska State Soil Survey  
Department of the Conservation and Survey Division

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## SOIL SURVEY

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## CONTENTS

	Page
County surveyed.....	1
Climate.....	3
Agriculture.....	5
Soils and crops.....	12
Well-drained upland and terrace soils.....	14
Hastings silt loam.....	15
Hastings silt loam, rolling phase.....	17
Holdrege very fine sandy loam.....	17
Hall silt loam.....	18
Hall very fine sandy loam.....	18
Hall fine sandy loam.....	19
Excessively drained upland and terrace soils.....	19
Colby silt loam.....	20
Colby very fine sandy loam.....	21
Colby fine sandy loam.....	21
Valentine sand.....	21
Valentine loamy sand.....	22
O'Neill fine sandy loam.....	22
Dune sand.....	23
Poorly drained upland soils.....	24
Scott silt loam.....	24
Bottom-land soils.....	24
Cass loamy sand.....	26
Cass fine sandy loam.....	26
Cass very fine sandy loam.....	27
Sarpy sand.....	27
Lamoure very fine sandy loam.....	28
River wash.....	29
Soils and their interpretation.....	29
Summary.....	33
Map.	

# SOIL SURVEY OF SHERMAN COUNTY, NEBRASKA

By L. A. BROWN, in Charge, and R. L. GEMMELL, Nebraska Soil Survey, and F. A. HAYES,<sup>1</sup>  
United States Department of Agriculture

## COUNTY SURVEYED

Sherman County is in central Nebraska (fig. 1). Loup City, the county seat, is 156 miles due west of Omaha. The county is square, each boundary being about 24 miles long. It comprises an area of 573 square miles, or 366,720 acres.

Physiographically the county is part of a great loess-mantled plain which once covered most of eastern and central Nebraska. This plain in Sherman County is crossed diagonally by Middle Loup River, Oak Creek, and Muddy Creek, which flow southeast in nearly parallel courses and which have carved rather broad valleys into the loose loessial mantle. Clear Creek, the largest branch of Muddy Creek, has also carved a rather broad valley. It flows southward in the western part of the county. Primary and secondary tributaries to these streams ramify nearly all sections of the uplands, producing a strongly rolling or hilly and broken surface, only irregular-shaped tabular remnants having been left to mark the level of the former plain. The largest and least eroded of these remnants are north and south of Middle Loup River in the southeastern part of the county. Numerous more or less eroded tabular remnants with strongly undulating or rolling surface relief lie somewhat below the level of the old plain in nearly all parts of the uplands.

The drainage system of the county, although intricate, is not deeply entrenched except along Middle Loup River and Muddy, Oak, and Clear Creeks, which lie from 80 to 100 feet below the general upland level. The tributaries of these streams are rather short with steep gradients, but their valleys in few places exceed 50 feet in depth except near the mouths of the streams.

The valley sides along the larger streams range from long and gradual to rather short and steep but are nowhere precipitous. The tributary drainageways are characterized by narrow V-shaped valleys near their heads, but they become progressively wider, with more gradually sloping sides, downstream.

The largest areas of rough and broken land are west of Middle Loup River in Bristol and Clay Townships and northwest of Loup City in Logan Township. In these localities the heads of drainageways have carved the loessial material into a succession of steep-

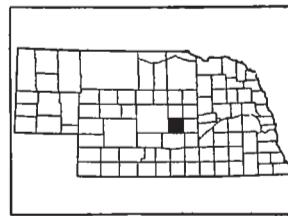


FIGURE 1.—Sketch map showing location of Sherman County, Nebr.

<sup>1</sup> Report written by F. A. Hayes.

sided though rather shallow V-shaped valleys separated by narrow tortuous crestlike divides. Smaller areas of similar character are in the northeastern, northwestern, and southwestern parts of the county, and narrow strips of rough and broken land border the heads of drainageways in nearly all parts of the uplands.

The alluvial lands, including the terraces and flood plains along the larger streams, occupy about 15 percent of Sherman County. The largest developments are along Middle Loup River and Oak, Muddy, and Clear Creeks. Those along the river attain a width of  $2\frac{1}{2}$  miles in places.

The terraces are much more extensive than the flood plains. They lie from 10 to 18 feet above the normal level of the streams and are not subject to overflow from the main channels. The surface relief ranges from nearly level to very gently undulating, except where the soil material is incoherent sand in which wind action has produced an uneven surface. About 3,000 acres of this sandy material having a hummocky or billowy and, in places, a rather hilly surface relief lie in the southeast corner of the county, and several small areas or narrow strips of hummocky sand land are in Middle Loup River Valley throughout its distance across the county. Most of the sand in these areas occurs on rather well defined terraces and was probably deposited by the river when it was flowing at a higher level. However, some of it may represent sandy strata which have been exposed on the lower slopes of the river valley. The soil material in part of the area in the southeast corner of the county has been whipped into dunes from 20 to 30 feet high, and the areas more nearly resemble the typical dune-sand areas of western Nebraska than wind-whipped terrace material.

The flood plains of Sherman County are well developed only along Middle Loup River, where they occur on both sides of the stream as almost continuous strips ranging in width from a few rods to more than one-half mile. They occupy the lowest positions in the county and are subject to overflow during periods of high water. The surface relief of the flood plains is nearly level but is modified in places by old and present stream channels, cut-offs, oxbows, slight elevations, and shallow depressions.

The average elevation of the county is about 2,200 feet above sea level. The highest elevation is on the uplands in the northwestern part, and the lowest is on Middle Loup River in the southeastern part. The total range in elevation is about 380 feet. There is a general downward slope to the southeast. The altitude<sup>2</sup> at Litchfield is 2,165 feet, at Hazard 2,109 feet, at Loup City 2,091 feet, and at Rockville, 1,980 feet. All these towns are in the valleys.

Practically all of Sherman County is well drained, and over a large part surface run-off is rapid and erosion severe. The only poorly drained land occurs in places in the bottom lands and in scattered shallow basins on the more nearly level upland divides.

Well water of excellent quality is readily obtained in practically all sections. Most of the upland wells range in depth from 200 to 250 feet. However, several of them are more than 400 feet deep, and some are less than 175 feet. The wells in the alluvial lands

<sup>2</sup> GANNETT, H. A DICTIONARY OF ALTITUDES IN THE UNITED STATES. U.S. Geol. Survey Bull. 274, ed. 4, 1,072 pp. 1906.

range in depth from 10 to 70 feet. There are a few springs along Davis Creek in the northeastern part of the county. They flow from a light-colored Tertiary sandstone which is exposed in numerous places on the valley sides.

Sherman County is in the prairie region of the United States, and native forest, mainly of willow, ash, elm, boxelder, and cottonwood trees, occurs only along the major streams. These trees are used very little for lumber, but they are of value locally for posts and fuel. The native grasses, in situations not disturbed by cultivation, are of the tall-grass sod type—chiefly big bluestem and little bluestem.

The first permanent settlement in the area now included in Sherman County was made at Loup City by settlers from Grand Island, Nebr., in 1873. The county was established and organized the same year, and its boundaries have remained unchanged.

According to the United States census data, the population has steadily increased since 1880. It was 2,061 in that year and 9,122 in 1930. The 1930 census classes all the population as rural. The larger valleys are much more thickly settled than the uplands.

Loup City, the county seat and largest town, located in the central part of the county, has a population of 1,446. Ashton, in the eastern part, with 435 inhabitants, ranks second in size. Litchfield, Rockville, and Hazard are important villages. All these towns and villages are on railroads, and they constitute markets and distributing points for farm implements, supplies, and produce.

Transportation facilities are good. A main line of the Chicago, Burlington & Quincy Railroad follows Muddy Creek Valley across the southwestern part of the county, and a branch of this system follows Oak Creek and Middle Loup River Valleys across the northeastern part. A branch of the Union Pacific Railroad follows the Middle Loup Valley to Loup City. These railroads furnish good connections with outside points.

The public-road system is well developed. State highways, most of which are surfaced with gravel, cross the county in several directions. The county roads, which generally follow section lines, are of earth construction but are kept in good repair. Cement bridges and culverts are common on nearly all roads.

All sections are served by rural mail delivery, telephones are in common use, and the public-school system is highly developed.

#### CLIMATE

The climate of Sherman County is temperate. There are rather wide variations in temperature between winter and summer, but the climate is well suited to the production of grain, vegetable, and hay crops and to the raising of livestock. The springs are cool, with considerable rainy weather, which favors rapid growth of winter wheat and the spring-planted small grains. The summers are long, with warm days and nights, which are especially favorable to the growth of corn. Low temperatures occur rather frequently during the winter but are usually accompanied by snow which protects winter-grown crops from serious injury. The autumns are long and pleasant, with only occasional periods of rainy weather, giving the farmer ample time in which to prepare and seed the land for winter wheat

and to harvest the corn crop. Variations in surface relief are not sufficient to cause appreciable differences in climate within the county.

Table 1, compiled from the records of the United States Weather Bureau station at Loup City, gives the normal monthly, seasonal, and annual temperature and precipitation.

TABLE 1.—*Normal monthly, seasonal, and annual temperature and precipitation at Loup City, Sherman County, Nebr.*

[Elevation, 2,067 feet]

Month	Temperature			Precipitation			
	Mean	Absolute maximum	Absolute minimum	Mean	Total amount for the driest year (1907)	Total amount for the wettest year (1905)	Snow, average depth
December.....	°F. 25.5	°F. 72	°F. -26	Inches 0.60	Inches 0.63	Inches 0.00	Inches 4.3
January.....	22.8	72	-39	.26	(1)	.45	2.4
February.....	25.9	76	-32	.48	.38	.40	4.7
Winter.....	24.7	76	-39	1.34	1.01	.85	11.4
March.....	36.4	90	-15	.93	.10	.94	5.2
April.....	49.4	98	8	2.48	.85	4.18	2.2
May.....	59.4	97	20	3.48	1.48	5.55	.2
Spring.....	48.4	98	-15	6.89	2.43	10.67	7.6
June.....	68.6	102	34	4.62	2.89	10.32	.0
July.....	74.2	106	40	4.00	1.93	4.15	.0
August.....	72.8	103	36	3.20	1.81	8.47	.0
Summer.....	71.9	106	34	11.82	6.63	22.94	.0
September.....	63.7	104	21	2.61	2.00	4.88	.0
October.....	51.2	97	5	1.71	.10	.73	1.6
November.....	37.2	88	-10	.70	(1)	1.55	1.9
Fall.....	50.7	104	-10	5.11	2.10	7.16	8.5
Year.....	48.9	106	-39	25.16	12.17	41.62	22.5

<sup>1</sup> Trace.

The average date of the last killing frost is May 8 and of the first October 2. This gives an average frost-free season of 147 days which is ample for the maturing and harvesting of all farm crops commonly grown. Killing frosts have occurred as early as September 12 and as late as May 27. During the years from 1895 to 1914, there were 4 years in which killing frosts occurred 10 or more days earlier in the fall and 5 years in which they were 10 or more days later in the spring than the average dates.<sup>3</sup>

The precipitation varies greatly from year to year. In the 20-year period, 1895-1914, it was less than 85 percent of the mean annual in about one-fourth of the years.<sup>4</sup> About 80 percent of the mean annual precipitation falls from April to September, inclusive, or dur-

<sup>3</sup> REED, W. G. FROST AND THE GROWING SEASON. U.S. Dept. Agr., Off. Farm Management, Atlas of American Agriculture \* \* \*, pt. 2, Climate, sec. 1, p. 9 (Advance Sheets no. 2), illus. 1918.

<sup>4</sup> KINCER, J. B. PRECIPITATION AND HUMIDITY. U.S. Dept. Agr., Off. Farm Management, Atlas of American Agriculture \* \* \*, pt. 2, Climate, sec. A, p. 5 (Advance Sheets no. 5), illus. 1922.

ing the principal part of the growing season. In summer the precipitation usually occurs as heavy thundershowers, though torrential rains are rare. Droughts are almost unknown during May and June, but in the latter part of July and during August short dry periods sometimes occur. However, crops seldom suffer from lack of moisture when properly tended, as the soils are usually able to supply them with sufficient moisture during periods of dry weather.

From about October 1 to April 1, the prevailing wind is from the northwest, and during the rest of the year it is from a southerly direction. Strong winds are common, though tornadoes are infrequent.

#### AGRICULTURE

Agricultural development in Sherman County began in 1873 when the first settlements were made. The earliest settlers located in the larger valleys where fuel and water were readily obtained and where the land surface favored easy cultivation. Corn and some garden vegetables were usually the first crops planted. In 1874, there was a large influx of settlers who homesteaded most of the remaining valley lands and a part of the uplands. Crops flourished during the spring and early summer of that year, but they were almost completely destroyed in late summer by grasshoppers. The settlers were so impoverished and discouraged that many of them left the county. During the next 2 years fairly good crop yields were obtained by the settlers who remained, and in 1877 another great influx of immigration took place. A railroad was constructed across the southwestern part of the county in 1886, and by 1890 practically all the land was settled.

Corn, game, garden vegetables, and beef were the chief means of sustenance for the early settlers. As conditions became more stable, wheat, rye, oats, and barley were grown. Good yields of all crops were usually obtained on the bottom lands and terraces, but yields were frequently rather low in the uplands, largely because of the lower moisture supply and greater susceptibility of the land to erosion. However, the upland farmers were able to draw on the experience of farmers who had become established on comparable lands in counties to the east and south, and they rapidly adjusted their farming practice to the requirements of the new region. Through the conservation of soil moisture and the prevention of serious erosion, the cultivable upland soils have been made almost as productive as the soils of the terraces and bottom lands.

The Federal census reports the value of all crops produced in Sherman County in 1929 as \$2,273,088. Dairy products, excluding those used for home consumption, were produced to the value of \$465,791 and poultry to the value of \$215,856. The total value of all domestic animals on farms in the county was \$2,637,891 on April 1, 1930.

According to the Federal census, 97.3 percent of the total land area of the county is in farms, of which nearly 58 percent was under cultivation in 1929, and most of the remainder was in range and pasture land. Corn is by far the most important crop, followed by alfalfa, wild hay, wheat, oats, barley, and rye, ranking in acreage,

during most years, in the order named. Minor crops include potatoes, millet, sorgo, garden vegetables, and fruits.

Table 2, compiled from Federal census data, gives the acreage and production of the principal crops in 1879, 1889, 1899, 1909, 1919, and 1929.

TABLE 2.—*Acreage and production of principal crops in Sherman County, Nebr., in stated years*

Crop	1879		1889		1899	
	Acres	Bushels	Acres	Bushels	Acres	Bushels
Corn.....	4,432	107,013	42,460	1,433,983	52,844	993,580
Wheat.....	4,271	46,164	11,856	138,053	46,703	282,830
Oats.....	910	26,743	11,861	257,722	10,400	164,230
Rye.....	201	2,277	192	2,823	2,226	16,030
Barley.....	257	4,383	629	7,806	575	4,740
Potatoes.....		17,324	1,181	100,893	681	56,763
Hay (all kinds).....	2,556	Tons 4,667	20,822	Tons 25,022	Tons 19,161	Tons 20,416
Wild.....					17,589	17,917
Alfalfa.....					162	508
Timothy and clover mixed.....						
Clover alone.....						
Coarse forage.....					92	117
Apples.....		Trees 874		Bushels 54	Trees 7,038	Bushels 259
Plums.....				587	1,028	141
Cherries.....				640	7	2,330

Crop	1909		1919		1929	
	Acres	Bushels	Acres	Bushels	Acres	Bushels
Corn.....	78,580	1,714,947	70,952	1,738,441	88,775	1,581,677
Wheat.....	26,249	393,988	34,005	359,867	16,547	190,606
Oats.....	18,681	239,711	17,309	478,562	25,021	765,038
Rye.....	288	2,727	4,384	45,885	1,677	21,455
Barley.....	120	1,687	4,335	86,630	6,433	166,455
Potatoes.....	841	42,914	789	26,773	729	63,942
Hay (all kinds).....	50,840	Tons 60,372	57,755	Tons 68,391	Tons 47,340	Tons 45,638
Wild.....	38,846		32,544		26,712	12,250
Alfalfa.....	13,097		25,927		36,005	23,346
Timothy and clover mixed.....	5		7		138	36
Clover alone.....	32		45		399	55
Coarse forage.....	176		390		10,205	1,343
Apples.....	6,317	Trees 4,036	8,711	Bushels 3,802	Trees 10,575	Bushels 6,883
Plums.....	901		1,614		1,551	289
Cherries.....	2,444		118		5,006	1,030

<sup>1</sup> The Nebraska agricultural statistics for 1930 report 10,014 acres in sweetclover in 1929.

Crop yields, although fairly uniform over long periods, vary somewhat from year to year in accordance with variations in the amount and distribution of precipitation and in the length of the frost-free season. Table 3, compiled from the 1930 Nebraska agricultural statistics, shows the average acre yield of the most important crops during the period 1925-29, inclusive, and the acre yield and the approximate percentage of the land area in the county devoted to each crop in 1930.

TABLE 3.—*Average acre yields of the principal crops in Sherman County, Nebr., 1925-29, and in 1930, with approximate percentage of the county devoted to each crop in 1930*

Crop	Average yield		Area in crops in 1930	Crop	Average yield		Area in crops in 1930
	1925-29	1930			1925-29	1930	
Corn.....	Bushels 20.8	Bushels 28	Percent 28.2	Alfalfa hay.....	Tons 1.92	Tons 2.5	Percent 6.4
Winter wheat.....	15.2	21	4.6	Wild hay.....	.74	1.0	7.2
Oats.....	26.8	37	6.8				

The returns derived from livestock constitute an important revenue. According to the Federal census, the value of livestock, including poultry and livestock products, greatly exceeded that of all farm crops in 1929.

Table 4, compiled from the Federal census reports gives the number and value of domestic animals and poultry in 1900, 1910, 1920, and 1930.

TABLE 4.—*Number and value of domestic animals and poultry in Sherman County, Nebr., in stated years*

Kind of live-stock	1900		1910		1920		1930	
	Number	Value	Number	Value	Number	Value	Number	Value
Cattle.....	23,601		31,171	\$686,043	31,338	\$1,376,006	30,322	\$1,519,404
Swine.....	26,528		38,109	322,736	39,019	747,616	46,063	623,518
Horses.....	6,722		10,742	1,041,427	10,758	651,241	8,742	416,340
Mules.....	338		728	70,322	757	64,641	725	43,740
Sheep.....	1,291		1,180	5,491	7,781	82,370	5,027	32,573
All poultry.....	66,482	\$26,111	96,794	40,090	138,463	96,114	141,115	215,856

The farm buildings, in general, are well painted and kept in good repair, and many of the houses are equipped with modern conveniences. In 1930, (137)<sup>5</sup> of the farmhouses had modern heating plants, (104) were equipped with electric lighting systems, and (419) had radios. All farms are fenced, mainly with barbed wire, though many are enclosed with hog-tight woven-wire fencing. The work animals include heavy draft horses and mules. There were (271) gas tractors, (94) trucks, and (1,398) automobiles on farms in 1930. The farm machinery is of the most modern and labor-saving types, including gang or sulky plows, disks, harrows, drills, listers, corn planters, mowing machines, cultivators, rakes, hay stackers, binders, manure spreaders, and wagons. There were (55) grain threshers, (4) wheat combines, and (1,105) cream separators on the farms in 1930. Many farms are equipped with corn binders, corn shuckers, hay balers, incubators, and silos. The more expensive farm machinery is sheltered.

In general, farm laborers are plentiful except during the small-grain harvest and the corn-shucking seasons, when good help is

<sup>5</sup>All numbers in parentheses are from Nebraska agricultural statistics, 1930.

often scarce. However, labor has been unusually plentiful and cheap during the last year, owing largely to the economic depression. In 1931, monthly farm wages ranged from \$25 to \$35 with board and lodging. Day labor was plentiful at \$2 and \$2.50. Corn shuckers received 2 or 3 cents a bushel for shucking corn. Many farmers hire help by the year.

In 1930, there were 1,466 farms in the county, and the average size of farms during that year was 243.5 acres. In the same year, owners occupied 53.9 percent of the farms, tenants 46 percent, and managers 0.1 percent. The proportion of tenant farms has steadily increased since 1880, when only 4.4 percent of the farms were operated by tenants.

Both the cash and share systems of rental, or sometimes a combination of the two, are followed. Share rental is the most popular, and in 1930 (72) percent of the acreage in tenant farms was rented on the share system. Under this system the owner receives two-fifths of the grain delivered and from \$2 to \$4 an acre for pasture land and the building site. All seed, labor, and machinery are furnished by the tenant. When alfalfa land is rented on shares, the owner receives half the hay stacked in the field. Under the cash system, it is customary for the tenant to pay from \$4 to \$6 an acre for the use of the land including the pasture areas. Land suited only for pasture is usually rented for a lump sum. On some farms the renter is allowed the use of the pasture land without charge. Only a small part of the land suited for grain production is rented for cash.

According to the records from the office of registrar of deeds at the county seat, there were 35 land transfers<sup>6</sup> in the county during the 12 months preceding March 31, 1930. These transfers involved 6,533 acres, and the average price obtained was \$54.53 an acre. The assessed valuation of the land during 1930 averaged \$33.50 an acre. The selling price of individual farms ranges widely, depending on the character of the soil, surface relief, drainage, improvements, and location with respect to markets.

The agricultural industries are closely related to the utilization of the crops. The cultivable land is used for feed crops and wheat, and the uncultivable areas are used largely for native pasture or hay. Wheat is the main cash crop, and most of it is sold in elevators which are maintained in nearly all the towns. Some wheat is sold in a flour mill at Loup City. The greater part of all crops, except wheat, is fed to livestock, either on the farms where produced or on farms situated within the county. The returns derived from livestock and livestock products, therefore, comprise the farmers' chief income. The raising and fattening of cattle and hogs are the most important branches of the livestock industry. Many cattle are raised locally, and in addition large numbers are purchased when 2 or 3 years old, either from the Omaha markets or from ranches in more western counties of Nebraska.

The Federal census reports that 135,984 acres, or about 37 percent of the total land area in Sherman County, were in pasture land in 1929. This land is rather evenly distributed, and cattle herds, ranging in size from 10 to 300 head, are grazed during the summer in

<sup>6</sup> These transfers do not include those reciting a consideration of \$1, love and affection, and other family transactions.

nearly all parts of the county. The native pasture grasses consist largely of big bluestem and grama, which are very nutritious and will ordinarily support from 300 to 350 cattle on each section (640 acres) during the grazing season—May 1 to October 1.

Cattle to be fattened for market are fed corn and alfalfa for a period ranging from 60 to 90 days and are then shipped to Omaha or Chicago. Many farmers fatten from 1 to 3 carloads of cattle each year. A few fatten calves for shipment as baby beef to the Omaha market. The calves when weaned are usually fed on oats. The ration is later changed to corn and alfalfa, and the animals are shipped when between 14 and 18 months old. Most of the beef cattle are of grade Hereford or Shorthorn breeding, and most of the herds are headed by a purebred bull.

Each farmer raises from 20 to 60 hogs a year, and some have herds of several hundred. Practically all the hogs are raised on corn and alfalfa. Barley and rye are frequently added to the ration. Many hogs are raised in connection with the feeding of beef cattle. All the hogs are of good breeding, and there are many purebred herds. Duroc-Jersey, Poland China, and Hampshire are the leading breeds. Practically all the hogs are fattened on the farms where raised, and most of them are sold in Omaha. Cholera sometimes disastrously affects hog raising, but the disease can be largely controlled through vaccination and increased sanitation.

Dairy products are an important source of income on most farms. No farm is devoted exclusively to the dairy industry, but most farmers keep from 5 to 10 milk cows, chiefly of mixed beef and dairy breeding, and sell their surplus dairy products to local cream buyers. According to the Federal census, 331,611 gallons of whole milk, 936,241 gallons of cream, and 8,819 pounds of butter were sold by farmers in 1929. Cream routes are established in nearly all parts of the county, and most of the cream is collected by the purchaser. A cream station is maintained in each town, and two creameries are located in Loup City. All cream not used in these creameries is shipped to Grand Island, Lincoln, or Omaha. Purebred dairy herds, chiefly Holsteins, are on a few farms in the vicinity of the larger towns. The abundance of alfalfa, to balance the corn ration, and the large area of native pasture land, together with good market facilities, combine to favor the extension of the dairy industry.

Sheep raising receives little attention. A few farmers annually ship in a carload or two of sheep for fattening, and some sheep are raised in the county. The Federal census reports 21,645 pounds of wool produced in 1929. The sheep to be fattened are fed corn, alfalfa, and sweetclover and are sold in the Omaha market when the price is favorable.

Horses, during recent years, have greatly declined in value, and horse raising is of minor importance in all sections of Nebraska. The Federal census reports only 411 colts born in the county in 1929. Most of the horses are of Percheron breeding. Purebred stallions are kept on a few farms, but most of the horses needed to carry on the farm work are purchased when 3 or 4 years old from ranchers in the western and northern parts of the State.

Chickens are a valuable asset on most farms. The local demand for poultry products is increasing, and poultry raising is receiving con-

siderable attention. Most farmers keep 50 or 60 chickens, and many maintain purebred flocks of several hundred. The principal breeds are Plymouth Rock, Leghorn, and Rhode Island Red. The Federal census reports 532,464 dozen eggs and 100,104 chickens sold in 1929. Many farmers maintain their flocks by raising baby chicks purchased from hatcheries in the larger cities. During 1929, 58,710 baby chicks were purchased by farmers. Most of the surplus poultry products are sold or exchanged for farm supplies in the local towns. Many of the chickens, however, are sold in a poultry-dressing and packing plant in Loup City.

Management of the land and methods of handling crops are similar to those practiced throughout central Nebraska. Corn, the most important crop, is planted in May, either with a corn lister or in checkrows with a corn planter. It is cultivated at intervals of 2 or 3 weeks until early in July, after which it receives no further attention until harvest. Corn matures in September or early October. The greater part is husked from the standing stalks, although many farmers cut part of it for fodder, and a few cut corn from 15 or 20 acres each year for silage. Silage corn is cut while the ears are in the dough stage. Many farmers annually fence off a few acres of unhusked corn for fattening hogs and cattle, thereby saving part of the expense of husking. Varieties of white or yellow dent corn are grown. Ordinarily the seed corn is not carefully selected, but most of it is produced in the locality where it is to be planted and has become adapted to local climatic and soil conditions.

Practically all the wheat grown is of the winter varieties, chiefly Turkey, Kanred, and Nebraska 60. The land to be used for wheat is usually plowed and harrowed in late summer, and the seed is planted with a press drill late in September. Some seed is drilled in between the corn rows early in the fall. Wheat usually makes a good growth before heavy frosts occur, remains dormant during the winter, resumes growth in early spring, and matures in July. It is cut with a binder or header, depending on the length of the stems, and is either shocked or stacked for threshing.

The wheat yield is sometimes reduced by stinking smut which distorts the kernels, prevents their normal growth, and gives the grain an offensive odor. This form of smut may be controlled by mixing the seed with copper carbonate powder at the rate of 2 or 3 ounces of the powder to a bushel of grain.<sup>7</sup>

Oats are planted and harvested in the same manner as wheat, but the land is prepared and the seed is planted in spring instead of fall. Kherson, Swedish Select, and Nebraska 21 are the leading varieties. Practically all the oats is used as feed, chiefly for horses and calves. The straw has a high feeding value and is fed to horses and cattle. Smut sometimes lowers oat yields during prolonged periods of rainy or cloudy weather. However, injury from this source can be controlled by spraying the seed the day before planting with a solution of equal parts of formaldehyde and water. One quart of solution is sufficient for treating about 40 bushels of oats.<sup>7</sup>

Barley is planted and harvested in the same manner as oats. The common 6-rowed smooth-bearded varieties are regarded as superior

<sup>7</sup> STEWART, P. H., and GROSS, D. L. SMUT CONTROL IN CEREALS. Nebr. Agr. Col. Ext. Circ. 132, 13 pp., illus. 1920.

for Nebraska conditions. Practically all the barley is used as hog feed.

Winter rye is generally grown for the grain and to some extent for hay and temporary fall pasture. When used for a grain crop it is seeded and harvested in the same manner as winter wheat. Rye is particularly well adapted to sandy soils. Rosen is the chief variety grown.

Alfalfa is the leading tame-hay crop. The varieties grown are among the most hardy obtainable, including Common, Grimm, and Cossack, all of which are resistant to winter-killing. Thorough plowing, followed by sufficient disking, harrowing, and possibly rolling, to control weed growth and compact the soil, is desirable in preparing the seed bed. The best results are usually obtained by planting the seed with a press drill after the first heavy rain in spring. The standard seeding rate is 15 pounds of good seed to the acre. Drilled seed is planted about one-half inch deep. A stand of alfalfa is usually allowed to remain as long as it produces profitably. A field is rarely frozen out. The crop is cut three times during the summer, and occasionally a fourth cutting is obtained. The common practice is to stack the hay in the field and haul it to the feed lots as needed. It is fed to cattle and hogs but seldom to horses, on account of its laxative properties. Many farmers run hogs in the alfalfa fields during the summer. Cattle, however, are seldom allowed to graze on green alfalfa, on account of the danger of bloating.

Wild hay is cut chiefly from the more steeply sloping parts of the uplands where cultivation would be difficult. Some is also obtained from the more poorly drained parts of the bottom lands. The upland hay is of excellent quality, consisting chiefly of big bluestem and wheatgrass. Most of the bottom-land hay is made from water-loving grasses and sedges, and it is rather coarse. Most of the hay is either stacked in the fields or stored in barns for winter feeding, and a small quantity is baled. It is fed chiefly to horses.

The use of sweetclover has increased remarkably in the last 10 years. It is valuable not only for pasture and hay but also for seed, for checking erosion, and for increasing the productivity of the soil for grain crops. The plant is a biennial and dies at the end of the second season, after producing seed. The most common time of seeding is in early spring. The seed bed is prepared in a manner similar to that required for alfalfa, and the seed is generally sown broadcast and covered with a harrow. When hay is desired, the crop is usually cut during the first year before the growth becomes coarse and weedy. The second year the crop may be allowed to mature and reseed itself, or it may be cut with a binder and threshed for seed. The permanence of a sweetclover stand depends entirely on its ability to reseed, and most farmers take care during the second year not to graze so closely as to prevent maturity of enough of the crop to reseed the land.<sup>8</sup>

Sweetclover has an unusually wide adaptation, as it thrives on both comparatively wet and dry soils and on soils of either sandy or clayey texture. It is regarded by most farmers as more satisfactory for soil improvement than either alfalfa or clover. The

<sup>8</sup> STEWART, P. H., and GROSS, D. L. SWEETCLOVER IN NEBRASKA. Nebr. Agr. Col. Ext. Circ. 122, 15 pp., illus. 1923.

crop not only adds organic matter to the soil but, in common with other legumes, has the power of fixing atmospheric nitrogen in nodules on its roots. It is a good soil binder and is especially valuable on the steeper valley slopes where erosion is severe.

No universal system of crop rotation is practiced. However, most farmers have evolved more or less indefinite systems subject to numerous substitutions. One of the systems which seems to have merit is corn 2 or 3 years, small grain 2 years, and alfalfa or sweetclover from 4 to 6 years. When alfalfa sod is broken, the land is generally used for small-grain crops for 1 or 2 years. On many tenant farms corn or wheat is grown on the same ground from 6 to 8 consecutive years.

Practically no commercial fertilizer is used. A large quantity of barnyard manure is produced, but in general little care is taken to preserve it, and much of its fertilizing value is lost through leaching. The manure is hauled in the fall or spring and is usually spread on land to be used for wheat or corn. On tenant farms, little care is taken to apply the manure where it is most needed, and the greater part is spread on land near the barnyard.

#### SOILS AND CROPS

A diversified farming system, including the raising and fattening of cattle and hogs and the growing of wheat and feed crops, is almost universally practiced in Sherman County. This system prevails largely because it affords a means for the economic utilization of the county's natural resources—climate, surface relief, and soils. The climate and most of the cultivable soils are well suited for the production of all crops common to this section of the country. However, the prevailingly level land is traversed by an intricate system of drainage, thereby producing a rather large aggregate acreage of steeply sloping or rather rough and broken land, much of which, on most farms, is topographically better suited for pasture land than for crop production. The economic utilization of this rough land necessitates the raising of cattle. Most of these animals and practically all the hogs, which are raised on nearly every farm, are fattened for market and require large quantities of feed. Therefore the greater part of the cultivable soils is used for feed crops, chiefly corn, alfalfa, and oats. The cultivable soils not needed for feed crops are used largely for wheat.

The diversified farming system commonly practiced allows the farmer to make the best possible use of his pasture and cultivable lands, and, since he is concerned largely with crops to be fed on his own farm, he can rotate these crops in such a manner as to continually maintain his soils in a highly productive state without detracting from his net annual returns. Leguminous crops, such as alfalfa and sweetclover, can be used to improve land not producing satisfactory grain yields, whenever necessary, without reducing the feed supply, and the productivity of any particular field can be increased by applying manure from the feed lots at no expense except that required for labor. In addition, the diversified system commonly practiced allows the growing of wheat on all land not needed for feed production, thereby giving the farmer a crop which can be sold for cash.

The cultivable soils occupy about 80 percent of the total land area and most of these soils produce high yields of all crops commonly grown on them. Prior to 1873, practically all the cultivable soils supported a luxuriant growth of prairie grasses. The annual decay of the grass roots produced an abundance of black well-decomposed organic material which accumulated in sufficient quantities to make the topsoils dark. In addition to their dark color most of the cultivable soils are characterized by a crumblike or granular structure in their topsoils, this feature persisting to greater or less extent in all except the more sandy soils. A third fairly uniform characteristic of the cultivable soils is the presence of lime in the subsoils, especially of the finer-textured soils, in sufficient quantities for crop needs. The organic-matter content and granular structure are valuable soil assets, especially for the production of corn which requires a mellow seed bed, a rather even soil temperature, and an abundance of moisture and nitrogen. The organic matter increases the water-holding capacity of the soil, assists in maintaining uniform soil temperature, and promotes favorable tilth. It is also the chief source of nitrogen. The granular or crumblike structure facilitates easy penetration of crop roots and allows free passage of air and water, which change the raw vegetal and mineral constituents of the soil into food suitable for the growing corn crop. Lime, although not a special requirement for corn, benefits this crop because it prevents the development of a sour, or acid, condition in the soil and assists in preserving the organic-matter supply and crumblike structure. It is a necessary soil constituent for the successful production of alfalfa.

Most of the uncultivable soils support good growths of prairie grasses, and some of them have one or more features common to the cultivable soils. However, these features in many places are poorly developed, and the uncultivable soils, as a whole, are either so severely eroded, poorly drained, or unstable that they are of value chiefly for pasture or native-hay land.

Each of the grain and tame-hay crops commonly grown in the county is produced on all the soils under cultivation. However, some of the soils are more productive of one crop than another, owing largely to differences in their organic-matter content, thickness and texture of their topsoils, and texture and compaction of their subsoils. Differences in the depth to the underlying water table also influence the yields of certain crops, particularly alfalfa and small grains. These differences directly control the storage of available moisture in the topsoil and subsoil and have determined to a large extent the proportional acreages devoted to the different crops on the different soils.

Corn, because of its adaptability to a wide range of soil and moisture conditions and because it is needed as feed for livestock, is naturally the leading crop on all the cultivated soils. However, this crop has a larger root system, matures later, and naturally requires a more abundant and continuous water supply throughout the summer than any other cereal crop commonly grown. It is therefore grown more extensively on soils with thick dark-colored topsoils and friable subsoils with high moisture-storing powers than on the shallower, lighter colored, or more sandy soils. Wheat, oats, and barley

occupy higher percentages of the areas characterized by well-drained and fine-textured soils than those including sandy or poorly drained soils, whereas alfalfa, which requires even more moisture than corn, occupies a higher percentage of the soils in the bottom lands and on low terraces than of those on the uplands and higher terraces. Alfalfa is seldom grown on the more sandy parts of the uplands or terraces. Rye, which does fairly well on rather impoverished and somewhat droughty soils, is grown more extensively on the lighter colored and coarser textured upland and terrace soils than any other crop except corn. Rye, however, gives the highest yields when grown on those soils best suited to wheat or oats.

Although the soils of the county differ in their agricultural value, so far as their use for certain crops is concerned, they may be placed in groups, each of which includes soils that are more uniform in their producing powers and crop adaptations and which are used for some particular crop or crops more extensively than soils belonging to another group. Four groups of soils, based on soil characteristics and other features that affect agriculture, are recognized, namely, well-drained upland and terrace soils, excessively drained upland and terrace soils, poorly drained upland soils, and bottom-land soils.

In addition to differences in drainage, the soils differ in other characteristics which affect agriculture, such as surface features, moisture content, compaction, and tendency to erode. None of the groups is confined to any particular part of the county, although some of the soils in each group are very local in their distribution.

In the following pages the individual soils of the different groups are described in detail, and their crop adaptations are discussed; the soil map accompanying this report shows the distribution of the soils; and table 5 gives their acreage and proportionate extent.

TABLE 5.—*Acreage and proportionate extent of the soils mapped in Sherman County, Nebr.*

Type of soil	Acres	Per-cent	Type of soil	Acres	Per-cent
Hastings silt loam.....	23,680	6.5	O'Neill fine sandy loam.....	1,280	0.3
Hastings silt loam, rolling phase.....	110,208	30.1	Dune sand.....	1,152	.3
Holdrege very fine sandy loam.....	2,368	.6	Scott silt loam.....	704	.2
Hall silt loam.....	40,896	11.2	Cass loamy sand.....	4,608	1.3
Hall very fine sandy loam.....	10,112	2.8	Cass fine sandy loam.....	5,824	1.6
Hall fine sandy loam.....	1,536	.4	Cass very fine sandy loam.....	5,632	1.5
Colby silt loam.....	143,744	39.2	Sarpy sand.....	704	.2
Colby very fine sandy loam.....	2,368	.6	Lamoure very fine sandy loam.....	1,344	.4
Colby fine sandy loam.....	832	.2	River wash.....	448	.1
Valentine sand.....	7,424	2.0	Total.....	366,720	-----
Valentine loamy sand.....	1,856	.5			

#### WELL-DRAINED UPLAND AND TERRACE SOILS

The well-drained upland and terrace soils occupy 51.6 percent of the total land area of the county. They occur throughout all parts of the well-drained uplands wherever erosion has not removed the dark-colored topsoils, and they include all but two of the terrace soils. Their surface relief ranges from nearly level to moderately rolling. The more nearly level areas are on the terraces and on the higher upland divides. All the soils have adequate surface and subsoil drainage, and some of them, on the more rolling areas where surface run-off is rapid, have been subjected to considerable erosion.

However, none of the soils has lost its dark-colored surface layer over any large area. The group includes the soils of the Hastings, Holdrege, and Hall series, each of which is represented by one or more soil types or phases of types, making a total of six individual soils. The Hastings and Holdrege soils occupy upland positions, and the Hall soils occur on terraces. All these soils have weathered from the light-colored floury and limy loess formation which covers most of the county.

The topsoils of the soils in this group are loose and mellow, are well supplied with organic matter, and are very dark grayish brown or almost black. They are thicker and darker than the topsoils of any other soils in the county, except a few of the bottom-land soils. They range in texture from fine sandy loam to silt loam, silt loam predominating. The subsoils are friable, are well supplied with lime, and allow easy root penetration and free air and water movement. All the soils have a high moisture-storing capacity. About 95 percent of the area occupied by the soils of this group is under cultivation. The remainder is included largely in building sites, feed lots, public roads, and small pastures for the milk cows and work animals.

The main crops are grown with excellent results on all the soils in this group. Slight differences are noticeable in the yields on different soils, but these are owing more to differences in topographic features, particularly the slope of the land and its elevation with respect to surrounding areas, than to differences in the soils themselves. The upland soils have more sloping surfaces, as a rule, than the terrace soils, and less of the rainfall sinks into these soils than into those on the benches. In addition, the upland soils are not so favorably situated to receive moisture from higher levels as the terrace soils and are naturally a little less productive, especially in dry years. However, all soils of the group are more productive than any upland soil not belonging to the group and are adapted to a wider range of crops than any of the bottom-land soils. In 1931, corn was grown on about 55 percent of the area occupied by the soils of this group, oats on about 20 percent, wheat on about 15 percent, and alfalfa on about 5 percent.<sup>9</sup> The rest of the land was used largely for rye, barley, sweetclover, and garden vegetables.

**Hastings silt loam.**—Hastings silt loam, together with its rolling phase, is the most extensive soil of the well-drained upland and terrace group. The surface relief ranges from nearly level to very gently undulating. This soil occurs chiefly in the southeastern and east-central parts of the county where it occupies the tops of the higher divides. It has developed from light-gray limy loess, under conditions of good surface drainage and underdrainage. The topsoil is well supplied with organic matter, is very dark, and ranges in thickness from 18 to 24 inches. It is everywhere loose and mellow and has a well-developed crumblike structure, the crumbs or granules being largest in the lower part of the topsoil, but few exceeding one-fourth inch in any dimension. The upper part of the subsoil is moderately compact and somewhat cloddy, especially when dry,

<sup>9</sup> All percentages, recorded in this report, of soil areas occupied by particular crops are estimates based on the observations of the soil surveyors during the progress of the field work.

but the material is not sufficiently dense to restrict root development or the movement of soil moisture. The lower part of the subsoil consists of loose flourlike silt and is limy throughout. It is underlain by gray loess.

The organic matter, with which Hastings silt loam is so well supplied, is most abundant in the upper 6-inch layer of the topsoil, where it averages about 3 percent by weight of dry soil material and thoroughly impregnates the small crumbs or granules. Between depths of 6 and 12 inches the organic matter is a little less abundant, comprising about 2 percent of the dry soil material. It is also less uniformly distributed than in the immediate surface layer, the greater part occurring as coatings on the outside of the granules. The coatings become thinner with depth, and the soil material becomes lighter in color. The upper part of the subsoil is brown, in contrast to the almost black color in the upper 6 inches of the topsoil. The lower part of the subsoil has received practically no organic matter and is light gray.

Hastings silt loam is well adapted to all crops common to the county. It is not quite so well supplied with moisture and organic matter and is therefore a little less productive, especially of corn and alfalfa, than some of the terrace and bottom-land soils, but it is adapted to a greater variety of crops than most of these soils. It is less extensive than Hastings silt loam, rolling phase, but its surface features are more even, it is less subject to erosion, is better supplied with moisture, and has a somewhat thicker topsoil than the more rolling land. It is more productive of all crops than any other upland soil in the county and is one of the most important agricultural soils. Practically all the land is under cultivation.

Crop yields on Hastings silt loam compare favorably with those obtained on the leading upland soils of the Mississippi Valley. However, they are a little more variable than those obtained in more eastern States, owing largely to a slightly greater variation, westward, in the annual rainfall. Corn yields range from 25 to 65 bushels, with an average of about 30 bushels an acre; wheat from 15 to 60 bushels, averaging about 20 bushels; and the oat and rye yields are about the same as those of corn and wheat, respectively. The average yield of barley is about 25 bushels, and alfalfa yields from 2 to 3 tons of hay an acre.

Although Hastings silt loam is as well adapted to alfalfa as any other upland soil in the State, it is, in common with nearly all upland soils of Nebraska, rather poorly suited to continued alfalfa production. The crop does well during the first few seasons, but the yields usually decline after 5 or 6 years, on account of insufficient moisture, and a second cropping to alfalfa is seldom as profitable as the first.<sup>10</sup> The alfalfa plant has an exceptionally long root system and extracts soil moisture to depths exceeding 25 feet. It is unable to produce maximum yields on moisture supplied by precipitation alone, and when the deep-seated moisture is exhausted yields naturally decline. Many years are required to replace the moisture removed from the deeper soil layers, even though the land is allowed to lie idle, and

<sup>10</sup> KIBSELBACH, T. A., RUSSEL, J. C., and ANDERSON, A. THE SIGNIFICANCE OF SUBSOIL MOISTURE IN ALFALFA PRODUCTION. *Jour. Amer. Soc. Agron.* 21: 241-268, illus. 1929.

reduced yields may be expected from a second cropping to alfalfa throughout the uplands.

The removal of deep-seated moisture in the uplands by alfalfa does not materially affect grain crops, because these crops depend largely on the moisture supplied by the annual precipitation. However, unfavorable yields of grain crops following alfalfa on Hastings silt loam and other upland soils frequently occur, but this is because the moisture from precipitation is insufficient for the increased vegetal growth produced in subsequent crops by the nitrogen stored in the soil by the alfalfa.

**Hastings silt loam, rolling phase.**—The rolling phase of Hastings silt loam is similar to typical Hastings silt loam in all respects except surface features and depth of the topsoil. This soil is more extensive than Hastings silt loam and occurs in nearly all parts of the uplands. It has developed from light-gray loess similar to that underlying typical Hastings silt loam but occupies less even divides and is strongly undulating or gently rolling. The topsoil is more variable in thickness, averaging a few inches thinner than the topsoil of typical Hastings silt loam, but areas having less than 12 inches of dark topsoil are very few.

This soil is well adapted to all the crops commonly grown. It is not quite so well supplied with organic matter, and therefore nitrogen, as typical Hastings silt loam. In addition, its less even surface relief favors more run-off, and less of the precipitation sinks into the ground than in typical Hastings silt loam. Practically all this rolling land is topographically suited to cultivation, and, although the soil produces slightly lower yields of corn and small grains than does Hastings silt loam, it is very productive. It seems to produce alfalfa as well as any other upland soil, probably because this crop is able to obtain most of its nitrogen from the air and much of its moisture supply from great depths, but alfalfa yields decline after five or six cropping seasons as on Hastings silt loam.

**Holdrege very fine sandy loam.**—Holdrege very fine sandy loam is similar in general appearance to the rolling phase of Hastings silt loam, but it contains a little more sand in its topsoil and has a more friable subsoil. It is also a little more rolling and much less extensive than the rolling phase of Hastings silt loam. Most of it lies near the edge of the uplands bordering Middle Loup River Valley in the southeastern part of the county. Small areas occur on the valley slopes of this stream and around the southern and western edges of the county.

The surface relief of Holdrege very fine sandy loam is more irregular than that of the other soils belonging to the well-drained upland and terrace group, and it ranges from strongly rolling to moderately hilly. The topsoil averages thinner than that of Hastings silt loam, rolling phase. However, it is 10 or 12 inches thick, is well supplied with organic matter, and is very dark, except in a few small spots where erosion has been unusually severe. It consists of mellow and friable very fine sandy loam or fine sandy loam. Its sand content, although noticeable, is not sufficient to make the soil unstable or to detract in any way from its agricultural value. The upper part of the subsoil resembles the corresponding layer of the Hastings soils,

except that it contains less clay and is more friable. The lower part of the subsoil is similar in all its features to the lower subsoil layer of Hastings silt loam and rests on the light-gray limy loess which underlies most of the uplands.

Holdrege very fine sandy loam is well suited to any crop commonly grown in the county, and practically all the land is under cultivation. Its rather uneven surface makes it a little more difficult to handle than the more nearly level soils of the uplands, and greater care is required to prevent erosion, but with careful management the soil is as productive of all crops as the rolling phase of Hastings silt loam. However it is of minor agricultural importance, owing to its small extent.

**Hall silt loam.**—Hall silt loam is the most extensive terrace soil in the county. It occurs in continuous strips or in bodies of various sizes and shapes in nearly all the major valleys. The largest developments are long Middle Loup River and Muddy, Clear, and Oak Creeks. The surface relief is nearly level or very gently undulating. The land lies from 8 to 30 feet above the stream channels and is not subject to overflow.

Hall silt loam, as mapped, is almost identical in its characteristics with Hastings silt loam, differing from that soil only in topographic position. It is well adapted to all the crops commonly grown but is used chiefly for corn, wheat, and alfalfa, ranking in acreage in the order named. In seasons of normal precipitation, corn yields are from 20 to 30 percent higher on Hall silt loam than on Hastings silt loam, and in dry years yields are often 50 percent higher. In average years, wheat yields from 10 to 20 percent more than on the Hastings soil. Alfalfa occupies a somewhat larger acreage in proportion to other crops on the Hall than on the Hastings soil. This crop usually yields about 3 tons of hay an acre each season.

The higher yields on the Hall than on the Hastings soil are owing more to differences in the moisture supply of the two soils than to soil differences. The Hall soil naturally receives some water in the form of run-off from the higher lying Hastings or Holdrege soils, which gives it a more favorable moisture supply than those soils. Alfalfa not only yields higher on Hall silt loam than on Hastings silt loam but can usually be grown more frequently on the Hall than on the Hastings soil without depleting the deep-seated moisture supply so essential for continued alfalfa production in Nebraska.

**Hall very fine sandy loam.**—Hall very fine sandy loam resembles the Hastings and Hall silt loams in all soil characteristics, except that it contains a little more very fine sand in its surface layer. It occurs on terraces similar to those on which Hall silt loam is developed, but it is much less extensive than that soil. Most of it is in Middle Loup River Valley.

This soil is as productive and as well adapted to all the crops commonly grown as Hall silt loam. In fact, the farmers recognize no difference in the producing powers or crop adaptabilities of the two soils, and both are regarded with equal favor for general farming. Practically all the Hall very fine sandy loam is under cultivation. However, the soil is of only local agricultural importance, on account of its comparatively small extent.

**Hall fine sandy loam.**—Hall fine sandy loam occupies a few small bodies on terraces in Middle Loup River Valley. Most of the areas occur in close association with more sandy terrace soils.

The topsoil of this soil is very dark grayish-brown fine sandy loam, differing from the topsoil of Hall silt loam only in that it has a higher sand content, and from the corresponding layer of Hall very fine sandy loam in that its sand is of a slightly coarser grade. The subsoil is similar in all its characteristics to the subsoils of the other Hall soils of the county.

All this soil is under cultivation and is used for the same crops as are grown on Hall silt loam. The land can be cultivated with a little less power and under a somewhat wider range of moisture conditions than either Hall silt loam or Hall very fine sandy loam, but it does not differ from those soils in producing power or adaptation to crops. In few places does it occupy more than a small part of the few farms on which it occurs, and it is, therefore, of little agricultural importance.

#### EXCESSIVELY DRAINED UPLAND AND TERRACE SOILS

The group of excessively drained upland and terrace soils occupies 42.8 percent of the total land area of the county. It includes 3 types of the Colby soils, 2 types of the Valentine soils, O'Neill fine sandy loam, and a few small areas of dune sand. The Colby soils and dune sand occur in the uplands, the O'Neill soils are on terraces, and the Valentine soils occupy both upland and terrace positions. The Colby soils are by far the most extensive soils of this group. They occupy all the more steeply sloping or more hilly parts of the loessial uplands and are composed largely of silt. Surface run-off on the steep slopes is rapid, and erosion is severe. The other soils of the group are composed largely of sand or mixtures of sand and gravel and are porous throughout. They occur mainly on the valley slopes or terraces along Middle Loup River. Their surface relief ranges from gently undulating to rather hilly, and they are characterized in numerous places by a decidedly hummocky appearance.

A few of the soils have fairly dark colored surface layers, but they are all rather low in organic matter, in comparison with soils of the well-drained upland and terrace group, and most of them are characterized by decidedly light colored topsoils.

The sandy soils of the group are low in lime, and most of them have rather incoherent topsoils which are subject to drifting during dry windy weather. The silty soils are very limy and are not subject to wind erosion, but in most places they are topographically unsuited to the use of farm machinery. Only about 35 percent of the area occupied by these soils is under cultivation, the remainder being used for pasture or hay land.

Corn occupies about 70 percent of the cultivated land, and sweet-clover, alfalfa, oats, and rye, ranking in acreage in the order named, occupy most of the remainder. Corn is grown most extensively, largely because it is needed for feed. It does not produce such high yields on soils of this group as on soils of the well-drained upland and terrace group, but it gives larger feed returns than any other

crop, especially on the sandy soils. Most of the alfalfa and oats are grown on the silty soils. Alfalfa seems to do almost as well on the light-colored silty soils as on the dark soils of the well-drained group, probably because it is able to obtain most of its nitrogen from the air and much of its moisture supply from deeper sources than can be reached by the roots of other crops. Oats are less profitable on the silty soils of this group than on the well-drained upland and terrace soils but are needed as feed for work animals and as a step between corn and alfalfa in most rotation systems. Rye is grown chiefly on the sandy soils of the group and sweetclover on both the sandy and silty soils.

**Colby silt loam.**—Colby silt loam covers about 90 percent of the area occupied by the excessively drained upland and terrace soils and 39.2 percent of the total land area of the county. It has developed from light-gray limy and floury silt similar to that underlying the Hastings and Holdrege soils, but which has been subjected to such severe erosion that it has not accumulated much organic matter. The soil as a whole lies considerably below the general level on which the Hastings and Holdrege soils are developed and is characterized by steep slopes and sharp divides. It occurs in all parts of the uplands, wherever drainage has carved the loess into a rugged relief. In the more eroded sections, soil slipping is common, and many of the steeper slopes show a succession of short vertical exposures locally known as catsteps.

The topsoil, which in few places is more than 6 or 7 inches thick, is loose friable silt loam ranging in color from dark grayish brown to ash colored, depending on the severity of erosion to which the material has been subjected. In most places the immediate surface layer, to a depth of 3 or 4 inches, is somewhat darker than the rest of the topsoil, owing to the presence of larger quantities of organic matter, but even this layer is very low in organic material, and therefore nitrogen, in comparison to the topsoils of the Hastings and Holdrege silt loams. The subsoil is ash-colored or grayish-yellow floury silt which grades at a depth of about 20 inches into almost white parent loess. The subsoil and, in many places, the topsoil are very limy.

About 70 percent of the area occupied by Colby silt loam is too rough for cultivation. The remainder, including the more gradually sloping and less eroded areas, is used for tame-hay and feed crops, chiefly corn, alfalfa, and sweetclover, ranking in acreage in the order named. Acre yields of corn on the cultivated areas average about 20 percent below those obtained on the dark-colored and nearly level Hastings soils of the uplands. Alfalfa and sweetclover yields, however, are only slightly below those obtained on the darker upland soils, probably because these crops are able to obtain much of their nitrogen supply from the air.

The uncultivated areas of Colby silt loam support a good growth of nutritious pasture grasses including big bluestem, grama, and June grass, and this is the leading pasture and native-hay soil in the county. The grasses will support about 60 head of cattle on each 160 acres during the summer grazing season or when cut for hay will yield about three-fourths of a ton to the acre.

**Colby very fine sandy loam.**—This soil occurs chiefly in the southeastern part of the county where it occupies small bodies and narrow strips, most of which are on the valley slopes along Middle Loup River. It is also locally developed in the adjacent uplands. It differs from Colby silt loam only in the slightly higher sand content of its surface layer. It has developed from gray limy upland silt similar to that underlying Colby silt loam, but it usually occurs in close association with rather sandy soils and has received sufficient wind-blown sand to give its surface layer a very fine sandy loam texture.

The surface relief ranges from rather steeply sloping to extremely rough and broken, and only about 20 percent of the land is under cultivation. Most of the remainder is unsuited topographically for the use of cultivating machinery and is included in pasture land. The same crops are grown on the cultivated areas as on corresponding areas of Colby silt loam, and the two soils are about equally productive. In fact, the farmers recognize no difference in the crop-producing or grazing values of Colby silt loam and Colby very fine sandy loam, provided comparisons are made on areas having similar relief.

**Colby fine sandy loam.**—Colby fine sandy loam occupies a few small scattered bodies, chiefly on the valley slopes south of Middle Loup River in the southeastern part of the county. Most of the bodies are adjacent to sandy soil areas.

This soil is similar to the other Colby soils, except that its surface features are a little less harsh and its topsoil to a depth of 8 or 10 inches is more sandy, ranging in texture from fine sandy loam to loamy sand. The sand which has blown on the soil from nearby sandy areas has rounded most of the irregularities and produced a strongly rolling or hummocky relief.

Most of the land is topographically suited to cultivation, but in many places the sandy topsoil is rather unstable when the native sod is destroyed, and practically all the soil is used for pasture land. The sandy surface layer rapidly absorbs the precipitation and acts as a mulch in curtailing evaporation, thereby making moisture conditions especially favorable for grass growth. The soil has a slightly higher grazing value than any other Colby soil.

The material beneath the topsoil is light-gray limy silt similar to that underlying the greater part of the uplands. It is highly retentive of moisture.

**Valentine sand.**—Valentine sand occurs in strips and bodies of various sizes in Middle Loup River Valley throughout its distance across the county. One of the largest developments occupies a long strip, comprising about 4 square miles, on the valley side northwest of Rockville. Several smaller strips are on the south side of the river northwest of Loup City.

The soil consists of grayish-brown incoherent sand to a depth of more than 6 feet. The topmost 4 or 5 inches has accumulated a little organic matter, and in most places the material here is slightly darker than the rest of the soil. However, the organic content is not sufficient to prevent drifting when the native sod is destroyed.

The surface relief over the greater part of the land is strongly undulating or rolling, and numerous areas occur in which the wind

has produced a pronounced hummocky relief. There is no surface run-off, as the precipitation rapidly percolates into and through the porous sand, and as a result the soil has been entirely leached of its lime.

Most of the Valentine sand is of little value for crop production on account of its unstable character, low organic-matter content, and low water-retaining power. Only about 30 percent of it, including areas in the lower lying positions where moisture conditions are most favorable, is under cultivation, and the rest is included in grazing land. The cultivated areas are used chiefly for corn which yields about 18 bushels an acre during average years. The grazing land produces a fairly good growth of big bluestem, sandgrass, and needlegrass, which will support about 25 head of cattle on each 160 acres during the summer grazing season.

**Valentine loamy sand.**—Valentine loamy sand occupies about 20 small bodies on the slopes and terraces in Middle Loup River Valley. One of the largest, comprising about 320 acres, is on the north side of the river about 3 miles southeast of Loup City. Most of the other bodies are much smaller, and the combined area of all areas of this soil in the county is only 1,856 acres.

Valentine loamy sand differs from Valentine sand only in that its topsoil is better supplied with organic matter and is a trifle darker and thicker. Nearly all this soil occurs in close association with Valentine sand, and its surface features and drainage conditions are similar to those of that soil.

About 50 percent of the land is under cultivation and is used chiefly for corn. The higher organic-matter content of the topsoil enables Valentine loamy sand to produce somewhat higher yields than Valentine sand, especially during the first 2 or 3 years after the land is broken. However, the organic matter, which is not sufficiently abundant to prevent the sand from drifting when the native sod is destroyed, rapidly decreases under cultivation, and the Valentine sand areas are annually becoming larger at the expense of Valentine loamy sand.

The average yield of corn during the first two or three seasons is about 20 bushels an acre, after which the yield is lower except during seasons of unusually high precipitation. The uncultivated parts of the soil support a rather heavy growth of sandgrass, needlegrass, and big bluestem, and they have a somewhat higher grazing value than areas of Valentine sand. During average years, about 30 head of cattle can be grazed on each 160 acres, or when the grasses are cut for hay about one-half ton an acre is obtained.

**O'Neill fine sandy loam.**—O'Neill fine sandy loam is the only terrace soil belonging to the excessively drained upland and terrace group in the county. This soil has developed from gray incoherent sands and gravels which were washed from the local sandy uplands and from regions to the west and deposited in the bottom lands along Middle Loup River when that stream was flowing at higher levels. Subsequent deepening of the stream channel left the surface of the deposits from 8 to 12 feet above the present flood plains.

This soil occurs in several small bodies in the river valley. Most of them are in the southeastern part of the county. The largest, comprising about 100 acres, is across the river south of Rockville.

The remaining bodies, although rather numerous, are smaller, and the total area of the soil in the county is small.

O'Neill fine sandy loam differs from Valentine sand in the lower sand and higher organic-matter content of its topsoil and in the coarser texture of its subsoil. The topsoil is thicker than that of Valentine loamy sand, and the surface relief is more even. The topsoil is well supplied with organic matter, is very dark, and is 10 or 12 inches thick. It ranges in texture from fine sandy loam to very fine sandy loam. However, the latter texture occurs in only a few small bodies, all of which are in the extreme southeastern part of the county and are not shown separately on the soil map. The higher organic-matter content of the topsoil gives O'Neill fine sandy loam considerable stability but not enough to entirely prevent soil drifting when the native sod is destroyed. The subsoil is composed of porous incoherent sand and gravel. It is brown in the upper part and gray or grayish brown in the lower. The soil throughout is very low in lime.

Areas of this soil are nearly level, except in a few places where wind action has produced slight depressions and low rounded ridges, but even in these localities differences in elevation in few places exceed 2 feet. Surface drainage is not established. The organic matter in the topsoil is able to hold some moisture, but the subsoil has low moisture-retaining power, and the soil as a whole is rather droughty.

About 70 percent of the land is cultivated, and the rest is used for native pasture or hay land. About 90 percent of the cultivated land is in corn and most of the remainder is in alfalfa or sweetclover, the latter being used largely for pasture. Corn yields are a little higher than on any of the Valentine soils, averaging about 25 bushels an acre. In a few places alfalfa seems to do even better than on the best silty soils of the uplands, probably because its roots are able to reach the underlying water table. Over the greater part of the soil, however, it is extremely difficult to obtain a good stand of alfalfa, owing to the loose sandy character of the seed bed, consequently yields of this crop average rather low. Small-grain crops are seldom grown.

The uncultivated areas of this soil have about the same grazing and hay-producing values as areas of the Colby soils. They support a thicker grass cover than any of the Valentine soils.

**Dune sand.**—Dune sand, although not a soil, is very loose and porous upland material and for this reason is included with the excessively drained upland and terrace soils. It occupies only two bodies in the extreme southeastern part of the county, the larger of which comprises about 1,100 acres and the smaller about 50.

Dune sand is incoherent grayish-brown sand which has been whipped by the wind into a succession of irregularly distributed hills and ridges, the tops of which are from 15 to 30 feet above the intervening valleys and pockets. Surface drainage channels are not established, as all moisture is rapidly absorbed by the loose porous sand. The material in most places supports a fair growth of sand-grass, needlegrass, and big bluestem, but bare spots, locally called blow-outs, occupy a square rod or two on many of the hills, especially on the northwest side.

All the dune sand is used as pasture land. The native grasses on this material will support about 20 head of cattle on each 160 acres.

#### Poorly Drained Upland Soils

The Scott soils are the only poorly drained upland soils in Sherman County. They occupy a few small shallow basinlike depressions scattered throughout the more nearly level parts of the loessial uplands and have a total area of only 704 acres. Only a few of the depressions occupy more than a few square rods, and they are locally known as "buffalo wallows" or "lagoons." Most of them are in the southeastern part of the county. They have no drainage outlets, and the water which collects in them after rains disappears slowly through seepage and evaporation. The excessive moisture has noticeably leached the lower part of the topsoil and has resulted in the development of a dense claypanlike subsoil. Even if drainage conditions allowed cultivation, the Scott soils would remain poorly adapted to grain and tame-hay crops, because their topsoils are too thin to store much moisture and the dense clay in the upper part of the subsoil is too poorly aerated and releases its moisture too slowly for these crops.

**Scott silt loam.**—The topsoil of Scott silt loam is rather heavy silt loam or silty clay loam ranging from less than 6 to about 8 inches in thickness. In most places this layer is well supplied with organic matter and is rather dark, especially in its upper part. However, it invariably contains more or less light-gray silty material, from which excessive moisture has removed the black organic matter, and in many places in the more poorly drained depressions the lower part of the topsoil is gray. The subsoil consists of dense lead-gray or slate-colored clay which contains scattered iron stains and concretions and both light and dark spots and splotches caused by poor drainage. The material is plastic when wet, and extremely hard and tough when dry. It extends to a depth ranging from 5 to 6 feet, where it gives way abruptly to light-gray floury loess. The excessive moisture has removed the lime from both the soil and the underlying loess to a depth exceeding 10 feet.

The areas of Scott silt loam are not suited to grain and tame-hay production, as most of them are too poorly drained for cultivation. The dense claypanlike subsoil is penetrated with difficulty by roots, and it practically limits the storage of available crop moisture to the topsoil which is too thin to store sufficient moisture for grain crops, especially during prolonged dry periods. However, this soil occupies only a small part of the farms on which it occurs and does not seriously affect the general value of the farm land. All of it is either included in pasture or is regarded as waste land.

#### Bottom-Land Soils

The soils belonging to this group occupy 5.1 percent of the total land area of the county. They have developed from sediments recently deposited in the bottom lands during periods of high water. They are represented by the Cass, Sarpy, and Lamoure soils and a material designated as river wash. These soils include five soil types which occur as bodies or strips, chiefly along Middle Loup River.

The surface of the bottom lands slopes almost imperceptibly down the valleys and toward the streams. There is practically no relief, except where the land is traversed by old and present stream channels or modified by slight elevations and shallow depressions. Surface drainage, although rather slow, is well established except locally. Much of the land is subject to overflow during high stages of the streams, but most of it lies from 3 to 5 feet above the normal level of the stream channels, and the water drains off within a few hours after the streams subside. About 80 percent of the land is adequately drained and is used for cultivated crops. The water table ranges from 4 to 15 feet beneath the surface of the ground, and the lower part of the subsoil is well supplied with moisture even during dry years.

The sediments from which the bottom-land soils have developed are of such recent origin that none of them has been greatly altered by weathering, and their composition is the dominant factor in determining the character of the soils. The sediments derived from the local loessial uplands are uniform and silty, whereas those derived from sandy and gravelly strata within or beneath the loess or from regions to the west are coarser. The mixing and reassorting of the fine and coarse particles has given rise to a varied assortment of sediments, especially in the bottom lands along Middle Loup River, where the sediments came not only from the local uplands but also from the great sand-hill region farther west.

The Cass and Sarpy soils and river wash have developed from the coarser stream sediments, chiefly sands and gravels, whereas the Lamoure soils are from the silts and clays.

The bottom-land soils are naturally better supplied with moisture than those on the uplands or terraces, because the precipitation received by them is supplemented by moisture from the underlying water table and by seepage and run-off from higher levels. The run-off also carries considerable organic matter and other plant foods to the lower levels. The moist conditions prevailing in the bottom lands have favored rapid vegetal growth and decay, and all except the Sarpy soils and river wash, which are developed from the most recently deposited sands and gravels, have dark-colored, in many places almost black, topsoils, owing to an abundance of organic matter. The high organic-matter content and the abundant moisture supply combine to make the darker colored and better drained bottom-land soils the most productive corn and alfalfa soils in the county, and most of the area occupied by them is used for these crops, corn being grown on about 80 percent of the cultivated land and alfalfa on about 15 percent. The remainder is used largely for sweetclover and timothy mixed.

The abundance of subsoil moisture in the bottom-land soils insures high alfalfa yields, even during years of low rainfall, provided a good stand of this crop is maintained. Small-grain crops also grow well, but they have a tendency to produce a rank vegetal growth with long weak stems which often break during windy weather. In addition, the small-grain crops usually mature late and produce rather low yields of grain. Oats yield fairly well, provided short stiff-stemmed varieties are grown, but even these varieties

have a tendency to grow rank at the expense of the grain and are of minor importance on these soils.

The uncultivated parts of the bottom lands, including the more poorly drained or less stable areas and areas covered by forest, are used for native hay or pasture land.

**Cass loamy sand.**—Cass loamy sand occurs in Middle Loup River Valley where it occupies narrow strips and small bodies, most of which are adjacent to the river channel. One of the largest developments, comprising about 800 acres, is on the north side of the river in Loup City Township. Smaller bodies, ranging in size from 15 to 500 acres, are scattered along the river throughout its distance across the county.

The almost black topsoil ranges from 8 to 12 inches in thickness. It is composed largely of fine sand or medium sand and organic matter, the organic matter being responsible for the dark color. The subsoil is loose gray or grayish-brown sand which in most places becomes coarser with depth and in many places is gravelly below a depth of 3 feet. The material may or may not be limy.

The surface relief is gently undulating, except locally where wind action has produced low ridges and shallow depressions similar to those in parts of the O'Neill fine sandy loam areas. Bodies of Cass loamy sand lie from 2 to 4 feet above the normal stream level, and the topsoil, except in local depressions, is well drained. However, the underlying water table during most years is within 8 feet of the surface of the ground and the subsoil, except in the driest seasons, is continually moist.

The topsoil, although composed largely of sand, is remarkably stable, owing mainly to its high organic-matter content. It is not subject to destructive wind erosion, except in a few small spots where the content of organic matter is unusually low.

About 90 percent of the land is under cultivation, and the remainder, including the more poorly drained areas and those covered with forest, is used for native pasture or hay land.

Cass loamy sand is one of the strongest and most productive corn and alfalfa soils in the county. Yields of these crops are a trifle lower than on the better Lamoure soils of the bottom lands but are higher than on any upland or terrace soil. The average yield of corn is about 45 bushels an acre and of alfalfa about 3½ tons. Alfalfa can be grown as continuously as desired on this soil without danger of depleting the subsoil moisture to a point where yields decline. Small grains grow well, but, as on all bottom-land soils, the abundant moisture supply causes these crops to produce excessive vegetal growth at the expense of the grain, and they are therefore of minor importance.

**Cass fine sandy loam.**—Cass fine sandy loam is slightly more extensive than Cass loamy sand. It occurs in numerous bodies and strips throughout the Middle Loup River bottom lands. The largest development, comprising about 400 acres, lies north of the river southeast of Rockville.

This soil resembles Cass loamy sand in all features except texture of the topsoil, this layer being composed of a slightly finer grade of sand in the fine sandy loam. The 8- to 12-inch topsoil is very

dark grayish-brown or almost black friable fine sandy loam. It rests on loose gray or grayish-brown sand which in most places is mixed with more or less gravel below a depth of 3 feet. Both topsoil and subsoil are faintly limy in most places.

This soil lies from 3 to 4 feet above the normal level of the river, but it is well drained and practically all under cultivation. Corn and alfalfa are the principal crops, although small fields of sweet-clover or clover and timothy mixed occur on many farms. Corn and alfalfa yield higher than on any upland or terrace soil and almost as high as on the better drained areas of the finer textured Lamoure soils of the bottom lands. Cass fine sandy loam is regarded by most farmers as slightly more productive than Cass loamy sand. Its surface relief is a little more even than that of the loamy sand, and there are no spots which have been subjected to destructive wind erosion.

**Cass very fine sandy loam.**—This soil is similar to the other Cass soils of the county, except that its topsoil is composed largely of a finer grade of sand than occurs in the corresponding layer of Cass loamy sand or Cass fine sandy loam. The topsoil is well supplied with organic matter and is very dark. The subsoil, beginning at an average depth of 10 inches, is gray or grayish-brown loose sand similar to that in the other Cass soils. This soil is closely associated with areas of Cass fine sandy loam but is slightly less extensive than that soil.

The surface of this soil is nearly level, and in general the land lies a few inches below that of the surrounding areas. The underlying water table is nearly everywhere within a depth of 5 feet and in wet years rises sufficiently to produce small areas of marshy land. Only about 60 percent of the land is sufficiently well drained for cultivated crops, and this is used chiefly for corn. Where adequate drainage is assured, corn yields are as high as on any other Cass soil in the county and are greater than on any upland or terrace soil. Alfalfa yields are also high during the first few seasons, but the exceptionally wet subsoil seems to be unfavorable in places to alfalfa roots, and yields of this crop decline on many fields in subsequent seasons. The poorly drained areas support a luxuriant growth of water-loving grasses which are used for hay and pasture.

Included with Cass very fine sandy loam are a few small bodies of Cass silt loam. The largest of these, comprising about 90 acres, is on the north side of the river south of Rockville. Smaller bodies are adjacent to or near the river channel in secs. 7 and 21, T. 16 N., R. 15 W., and secs. 16 and 23, T. 13 N., R. 13 W.

This included soil differs from Cass very fine sandy loam chiefly in the finer and more silty character of its topsoil. Practically all of it is rather poorly drained and is used for pasture or hay land.

**Sarpy sand.**—Sarpy sand occupies small bodies and narrow strips in the Middle Loup River bottom lands. The largest development, comprising about 100 acres, borders the east bank of the river in Logan Township. The other bodies are much smaller.

Most of the Sarpy sand has developed from recently deposited river sands which have not accumulated much organic matter. Some of it, however, has developed from Cass loamy sand, the topsoil of which has been practically depleted of its organic matter through

wind erosion. In some places Sarpy sand resembles river wash, but it is more stable and not so greatly influenced by each slight rise of the stream.

The topsoil consists of a 6- to 8-inch layer of gray or grayish-brown incoherent fine sand or medium sand. It is underlain to a depth exceeding 5 feet by material of similar consistence though of slightly coarser texture and lighter color. The 2- to 3-inch surface layer in most places contains some organic matter and is a little darker than the rest of the soil. However, the organic matter is not sufficient to prevent soil drifting when the natural vegetation is destroyed, and it rapidly disappears if the land is overgrazed or cultivated. The soil is not limy.

Areas of Sarpy sand are nearly level or gently undulating. They lie from 3 to 4 feet above the normal level of the river, and, although the soil is subject to occasional overflow, it is not covered with water except during unusually high stages of the stream. The subsoil is moist but not poorly drained.

About 30 percent of the land is used for corn and about 10 percent for sweetclover and alfalfa. Most of the remainder supports a scattered tree growth and is included in pasture land. Although the organic-matter content is very low, the moisture supply is abundant, and fair yields of corn are obtained on the cultivated areas in most years. Alfalfa, provided a good stand is obtained, yields almost as high on this soil as on the dark-colored Cass soils, probably because it does not depend entirely on organic matter for its nitrogen supply. A good stand of alfalfa, however, is difficult to obtain in many places, owing to the loose sandy character of the seed bed. The average yield of corn over a period of years is about 20 bushels an acre. Practically all the sweetclover grown on this soil is used for pasture.

**Lamoure very fine sandy loam.**—Lamoure very fine sandy loam occupies scattered bodies on the Middle Loup River and Muddy Creek flood plains throughout their distance across the county. One of the largest developments, comprising about 400 acres, is northwest of Austin, and an area including about 300 acres is 3 miles south of Loup City. Few of the remaining bodies exceed 80 acres in extent.

The surface of this soil is nearly level. In most places this soil lies a little lower than the surrounding bottom-land soils, and it is rather poorly drained, especially in early spring. However, most of the land is sufficiently dry for cultivation by crop-planting time, and about 80 percent of it is used for grain and tame-hay crops.

The black topsoil is about 18 inches thick. It is not very uniform in texture, ranging from silt loam to fine sandy loam within a distance of a few rods. However, the topsoil of most of the bodies averages very fine sandy loam, and on the accompanying soil map all the Lamoure soils are included with this type. The topsoil is friable and easily tilled, except in a few of the more silty spots, where it has a tendency to form clods if plowed when wet and is rather difficult to cultivate when dry. Under average moisture conditions, however, even the silty spots have good tilth. The subsoil ranges in color from light gray to almost black, but in most places it is gray or mottled gray and brown. It consists of heavy silt loam or silty

clay loam but is not compact, and it is easily penetrated by roots and moisture. The material is very limy, much of the lime, especially in the bodies with lighter colored subsoils, occurring in small hard or soft concretions and in irregular-shaped spots and splotches.

Lamoure very fine sandy loam is the strongest and most productive corn and alfalfa soil in the county, and the cultivated areas are used chiefly for these crops in the proportion of about 8 acres of corn to 1 of alfalfa. Some sweetclover is grown for pasture. Small grains are of minor importance, being grown only as a step in the rotation, between corn and alfalfa, or as a nurse crop for alfalfa. Yields of corn and alfalfa on the better drained areas are about 10 percent higher than on the Cass soils. The more poorly drained areas are used for pasture and hay land.

**River wash.**—River wash, although not a true soil, has been formed from recently deposited stream sediments and is included in the group of bottom-land soils. It consists of sand bars, islands, and sand flats within, or adjacent to, the channel of Middle Loup River, and only the larger areas are shown on the soil map. The material differs from Sarpy sand in its less stable character and the almost total absence of organic matter.

River wash lies only a few inches above the normal level of the stream and undergoes change with each slight rise of the channel. Even during normal flow, small areas are shifted about, added to, or carried away by the varying current. The material represents the first stages of alluvial-soil formation and with the gradual accumulation of organic matter will develop into Sarpy sand. Most of the land supports a rather dense growth of seedling willow trees and is used for pasture or is regarded as waste land.

#### SOILS AND THEIR INTERPRETATION

The soils of Sherman County have developed under climatic conditions which have favored the annual growth and decay of a luxuriant grass vegetation and the accumulation, especially in the topsoils, of much well-decomposed vegetable material. Most of them have developed either *in situ* or otherwise from remarkably uniform light grayish-yellow calcareous silt, known geologically as Peorian loess. A few, however, most of which are in the valley of Middle Loup River, have developed from sandy or gravelly materials.

The regional soil-forming agencies, chief among which are the prevailing climate and vegetation, have greatly altered the topmost part of the geologic materials in most places and have produced the present soils. The effectiveness of these agencies in transforming the geologic material into soil in a given locality depends on the character of that material, on the topographic and drainage conditions under which it has weathered, and on the length of time it has been subjected to undisturbed weathering. Most of the differences in the soils are owing to differences in the surface features which control the quantity of water entering the soil and the rapidity of the surface run-off. However, a few particularly marked differences in the texture, coherence, and lime content of the subsoils are owing largely to differences in the character of the parent soil materials.

The soils of level or depressed areas, where surface drainage is slow or absent, have been subjected to the largest quantities of water

and show well-marked characteristics, chief among which are more or less advanced stages of leaching, especially in the topsoils, and of translocation of clay into the subsoils. On rolling or hilly areas, leaching and the translocation of clay are less pronounced, but the rapidity of the surface run-off has greatly thinned or otherwise modified the topsoils through erosion, especially on rolling or hilly areas of the more silty soils. The soils developed from sands or gravels are rather thoroughly leached, regardless of their surface relief. However, the sandy soils show little accumulation of clay in their subsoils, partly because the quartzitic sands of which they are largely composed are extremely resistant to weathering and the formation of clay, and partly because the soils are so porous that practically all the fine material can pass through them in the under-drainage.

Throughout the county slight or pronounced variations in the character of the parent material, differences in the quantity of water entering the soil, and differences in the rapidity of the run-off have resulted in the development of a number of distinct soils.

Those soils which have been formed under good but not excessive drainage, from parent materials most easily affected by weathering, and which have lain in their present positions undisturbed by erosion for the longest periods, have accumulated large quantities of organic matter and have thick dark topsoils. They have also developed well-defined layers, or horizons, lying parallel to the surface of the ground, occurring in a definite order of succession and differing from one another in one or more easily discernible features, such as color, lime content, structure, and compaction. The characteristics of these soils have been produced under the most favorable conditions for soil development afforded by the region. The soils, therefore, have received the full impress of the regional climate and vegetation and may be regarded as fully developed.

Those soils which have been formed under poor drainage, excessive drainage, or from parent materials extremely resistant to weathering have developed under the same climatic environment as the fully developed soils and have some of the features common to those soils. However, conditions have not been so favorable for deep soil weathering as in the fully developed soils, and one or more of the soil horizons is absent or poorly defined. The soils which have not received the full impress of their climatic and vegetative environment are regarded as imperfectly developed. There are, therefore, in the county, two broad groups of soils—fully developed soils and imperfectly developed soils.

Fully developed soils occupy about half the total land area of the county. They include the Hastings, Holdrege, Hall, and O'Neill soils, one or another of which occurs in nearly all parts. The Hastings and Holdrege soils occupy upland positions, whereas the Hall and O'Neill soils are on terraces.

Following is a description of the profile of Hastings silt loam observed on a nearly level remnant of the old loess plain in the eastern part of the county:

From 0 to 6 inches, very dark grayish-brown friable silt loam. The surface layer of this horizon to a depth of three-fourths inch is structureless. The next lower layer, which is 2 inches thick, is faintly laminated, and the rest of the horizon is composed of soft angular granules which are irregular in shape and average about one-fourth inch in diameter.

From 6 to 20 inches, the material is dark grayish-brown granular silty clay loam. It is a trifle more compact than that in the overlying horizon, owing largely to its somewhat higher clay content, and the granules are firmer and somewhat larger than those in the horizon above.

From 20 to 43 inches, grayish-brown heavy silty clay loam. The material in this horizon has a rather cloddy structure and is noticeably more compact than in any other horizon in the soil profile. The clods are crushed with difficulty between the fingers and thumb when the material is dry but are rather soft and friable in their natural moist condition. The material nowhere attains the density of a claypan.

From 43 to 57 inches, light grayish-brown cloddy or structureless silt loam. The material is rather friable and seems to be transitional in most of its features between that of the overlying and underlying horizons.

From 57 to 78 inches, the zone of maximum carbonate enrichment, which consists of very light grayish-brown friable silt. The material is structureless and contains an abundance of lime, chiefly in the form of white concretions, splotches, spots, and in finely divided form. It is underlain by very light grayish-yellow Peorian loess which, although highly calcareous, contains only a few small scattered spots in which the carbonates are concentrated.

The color, texture, and structure transitions between the different horizons are gradual. The upper limit of lime concentration is rather sharply defined, but the lower one is indefinite, and the material in the zone of maximum carbonate enrichment grades almost imperceptibly into the parent loess.

The upper soil layers are rich in organic matter, which accounts for their dark color. The organic material in the surface horizon is rather thoroughly mixed with mineral soil particles, but beneath this it occurs chiefly as a film or coating on the surfaces of the structure particles. The film decreases in thickness with depth, and below 45 inches the soil appears to be practically devoid of organic matter.

The moderate compaction between depths of 20 and 43 inches is probably caused by the downward translocation of the finer textured particles from overlying layers through the agency of percolating waters. This agency transporting carbonates has also probably caused the high lime content of the horizon beneath the zone of maximum compaction.

Aside from slight textural differences in their topsoils, the Hall and Holdrege soils are similar in major features to the soil described. In fact, the profile of Hall silt loam is almost identical with that of Hastings silt loam. The Hall soils, however, are developed on loessial terraces, whereas the Hastings soils occur on the loessial uplands.

The Holdrege soils as mapped have developed from upland Peorian loess similar to that from which the Hastings soils have developed, but they occupy slightly less even areas than either the Hastings or Hall soils. The surface relief in most places is undulating or very gently rolling, and less of the precipitation sinks into the ground than in the more nearly level areas. The Holdrege subsoils, therefore, have received less clay from overlying layers and are less deeply leached of their carbonates than the Hastings and Hall subsoils. They are friable, even when dry, and their horizon of maximum carbonate enrichment is in most places within a depth of 4 feet. Run-off, except in local spots, has not been sufficiently rapid to noticeably thin the surface layers of the Holdrege soils, and these layers are identical with those of the Hastings and Hall soils.

The O'Neill soils occupy terraces which are comparable in their surface features to those on which the Hall soils occur but which are

formed of noncalcareous sands and gravels. This coarse-textured terrace material has undoubtedly been subjected as long to the action of the prevailing soil-forming agencies—climate and vegetation—as the material composing the loessial terraces. The O'Neill soils of the sandy benches, therefore, must be regarded as fully developed soils. However, they have attained this stage of development on parent material differing greatly in physical and chemical features from Peorian loess, and the O'Neill soils naturally differ in many of their characteristics from the Hall soils. Their surface layers are as well supplied with organic matter and are as dark and thick as the corresponding layers of the Hastings and Hall soils, but they are more open, porous, and sandy than those layers. The upper part of the subsoil, which lies between depths of about 14 and about 24 inches, is a heterogeneous mixture of all grades of sand and more or less fine gravel. The sand and gravel particles are coated with a thin organic film which gives the material a decidedly brown or grayish-brown color. The film decreases in thickness with depth. Below an average depth of 30 inches is a loose incoherent mixture of gray sand and gravel. The porous surface soil and subsoil have allowed all material moving downward in solution or suspension to pass through in the underdrainage. The profile has no layer of clay concentration, so characteristic of the Hastings and Hall soils, and it is thoroughly leached of its carbonates.

The imperfectly developed soils occur in all parts of the uplands not occupied by the Hastings and Holdrege soils and also include all the bottom-land soils. They comprise the Colby, Scott, Valentine, Cass, Sarpy, and Lamoure soils, in addition to small areas designated as dune sand and river wash.

The Colby soils have developed from Peorian loess under severe erosion. They occupy steep slopes, sharp ridge crests, and rough and broken land, all of which are along, or around the heads of, the numerous drainageways throughout the uplands. The rapid surface run-off has removed the soil material almost as fast as it has formed and has not allowed leaching of the carbonate from the underlying layers faster than new material has been exposed at the surface. Constant erosion has prevented the accumulation of organic matter in quantities sufficient to more than slightly darken the top-soils which in most places are grayish brown and rest directly on the yellowish-gray parent loess. These soils have not developed a zone of lime concentration. In many places erosion has entirely removed all organic matter, exposing the highly calcareous Peorian loess.

The Scott soils have developed under deficient drainage. They occupy a few small shallow basins throughout the more nearly level parts of the loessial uplands. Water accumulates in the basins after rains and often remains on the surface of the ground for several weeks. Downward percolation of water is excessive, and its results are pronounced. The topsoils are friable or only slightly compact, and they range from less than 4 inches to about 8 inches in thickness. They vary greatly in structure but in most places are more or less laminated and in few places contain much granular material. The upper half or three-fourths of the topsoil has an almost black

basic color, but it is invariably sprinkled with light-gray or almost white floury silt, from which the organic matter has been leached. The lower part of the topsoil may or may not be dark. Its color depends on the amount of leaching to which the material has been subjected and may range from very dark to almost white. Where unusually light in color, much of the material contains numerous black, hard, and almost round ferruginous concretions from one-eighth to slightly more than one-fourth inch in diameter.

The subsoil is an extremely dense clay, probably formed by prolonged downward translocation of the finer textured topsoil particles. Excessive moisture and poor aeration have given the clay a lead-gray or dark bluish-gray color, in many places mottled with rust-brown stains, streaks, and spots. The material contains scattered black concretionary forms similar to those occurring in many places in the lower part of the topsoil. Beneath the dense clay, which extends to a depth ranging from 5 to 6 feet, is the parent Peorian loess. The entire soil, as well as the upper 3 or 4 feet of the underlying loessial material, has been leached of its carbonates.

#### SUMMARY

Sherman County is in central Nebraska. It is square, each boundary being about 24 miles long.

The county was formerly covered by a nearly level loess-mantled plain which is now crossed in a northwest-southeast direction by the valleys of Middle Loup River, Oak Creek, Turkey Creek, and Muddy Creek. These streams, together with their major and minor tributaries, have ramified nearly all sections. Irregular-shaped divides with flat or gently rolling surfaces, which probably lie at or near the level of the old plain, occur throughout the uplands, but the county as a whole has a sharply rolling or hilly surface relief intersected by numerous strips of nearly level alluvial lands.

The average elevation of the county is about 2,200 feet above sea level, and the total range in elevation is about 380 feet. There is a general slope downward to the east, and practically all the land is well drained.

The first permanent settlement was made in 1873, and the county was organized the same year. According to the Federal census reports, the population was 9,122 in 1930. Loup City, the county seat and largest town, has 1,446 inhabitants.

The climate is continental and temperate. It is well suited to grain and hay production and to the raising of livestock. According to the Weather Bureau records, the mean annual precipitation is 25.16 inches, and the mean annual temperature is 48.9° F. The average frost-free season extends over a period of 147 days.

According to the Federal census, about 58 percent of the farm land was under cultivation in 1929, and most of the remainder was in range and pasture land. Corn is by far the most important crop, followed by alfalfa, wild hay, wheat, oats, barley, and rye, ranking in acreage, during most years, in the order named. The growing of these crops and the raising and fattening of cattle and hogs completes the diversified farming system which is almost universally practiced. Most of the wheat is sold for cash, but the other crops

are usually fed on the farms where produced to cattle and hogs, which are the chief sources of income.

The farm improvements are good, and most of the farms are equipped with modern labor-saving machinery.

In 1930, owners occupied 53.9 percent of the farms, tenants 46 percent, and managers 0.1 percent. During that year, 72 percent of the acreage in tenant farms was rented for a share of the crops, and most of the remainder for cash. Under the share system the owner usually receives two-fifths of the grain and from \$2 to \$4 an acre for the pasture land. Cash rent ranges from \$4 to \$6 an acre.

The soils, as a whole, are naturally productive. They have developed under a prairie-grass vegetation and, except where severely eroded or composed of unstable sands, have dark-colored topsoils, owing to accumulations of black well-decomposed organic matter derived from decayed grass roots.

On the basis of their agricultural values and their most pronounced characteristics, the soils may be divided into four broad groups, namely, well-drained upland and terrace soils, excessively drained upland and terrace soils, poorly drained upland soils, and bottom-land soils. The well-drained upland and terrace soils comprise 51.6 percent of the total land area of the county. They occupy the well-drained but less eroded parts of the loessial uplands and include all but one of the terrace soils. The Hastings, Holdrege, and Hall soils belong to this group.

Hastings silt loam occupies the more nearly level upland divides. It has a thick dark topsoil which is well supplied with organic matter. The subsoil, although moderately compact, affords easy root penetration and free air and water movement. It is very limy in the lower part. This soil is well adapted to all crops commonly grown in the county and is one of the most important general-farming soils.

Holdrege silt loam is similar to Hastings silt loam, except that its topsoil is a little thinner and its subsoil more friable. It also occupies areas having a little less even surface relief than Hastings silt loam, and it is more subject to erosion. However, it is well adapted to all crops grown in the county and when carefully managed to prevent erosion is almost as productive as the more nearly level soils of the loessial uplands.

The Hall soils occupy well-drained terrace positions. They are similar in general characteristics to the Hastings soils of the uplands, but they receive surface run-off from higher lying areas and have a more favorable moisture supply than those soils. They are adapted to all crops common to the region and give a slightly higher yield than the best upland soils of the county.

The excessively drained upland and terrace soils occupy 42.8 percent of the land area of the county. This group includes the Colby, Valentine, and O'Neill soils and small areas of dune sand. All except the Colby soils are composed largely of sands, and none of them is able to retain for crop use as much of the moisture which falls on it as is retained by the well-drained upland and terrace soils.

The Colby soils are extensively developed. They occupy the most severely eroded parts of the loessial uplands, and rapid surface run-off has prevented the accumulation of much organic matter. The

topsoils are light colored and rather thin. Owing to the unfavorable surface relief, much of the land is unsuited to cultivation, and the greater part of the area occupied by these soils is used for pasture.

The Valentine soils are sandy throughout. They occur in narrow strips and scattered bodies on the valley slopes and terraces along Middle Loup River. The surface relief is rolling or hummocky. These soils are low in lime, rather unstable, and have accumulated very little organic matter. The topsoils are prevailingly light in color, and the subsoils are composed of incoherent gray sand. Corn is grown in the lower lying positions, where moisture conditions are most favorable, but the yields are rather low. The greater part of the Valentine soils is used for pasture and hay land.

The O'Neill soils occupy nearly level sandy terraces in Middle Loup River Valley. Although composed largely of sand, they have accumulated an abundance of organic matter and have thick dark-colored and rather stable topsoils. However, the subsoils are composed of incoherent brown or grayish-brown sands and gravels, and the soils as a whole are rather droughty. About 70 percent of the area occupied by them is used for corn and alfalfa. Yields average lower than on the silty upland and terrace soils but exceed those obtained on the Valentine soils.

Dune sand occupies a small area in the southeast corner of the county. It consists largely of sand which has been whipped by the wind into an irregularly distributed succession of low hills and ridges. The material supports a fair growth of grasses and is at present rather stable. However, it drifts badly if overgrazed or brought under cultivation.

The only poorly drained upland soil in the county is Scott silt loam which occupies a few small basinlike depressions, locally known as buffalo wallows, most of which are within areas of Hastings silt loam. Scott silt loam is characterized by a rather thin dark-colored topsoil and a very dense and claypanlike subsoil. It is too poorly drained for cultivation.

The bottom-land soils occupy 5.1 percent of the land area of the county. This group includes the Cass, Sarpy, and Lamoure soils and river wash, all of which have been developed from recently deposited stream sediments. The Cass and Sarpy soils are from the coarser textured sandy and gravelly sediments, and the Lamoure soils are from silts and clays. All the bottom-land soils, except the Sarpy, are well supplied with organic matter and have dark-colored topsoils. The Cass and Lamoure soils are the most productive corn and alfalfa soils in the county. The Sarpy soil is composed almost entirely of loose gray sand and is used chiefly for grazing land.

River wash includes sand bars, islands, and flats within, or adjacent to, the channel of Middle Loup River. It is composed of recently deposited sands and gravels, and in most places it supports a rather heavy growth of seedling willows. Practically all of it is included in pasture land.





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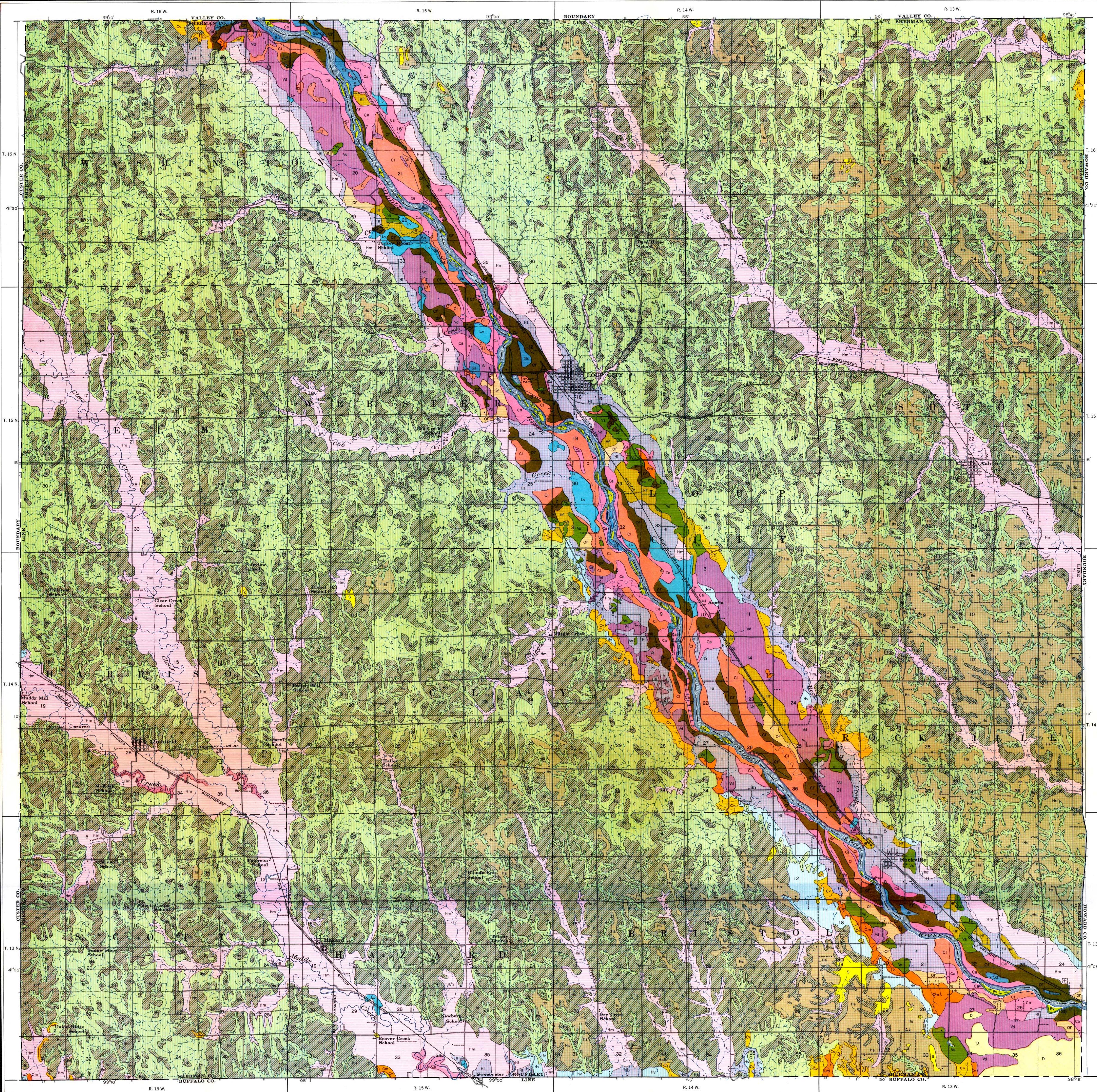
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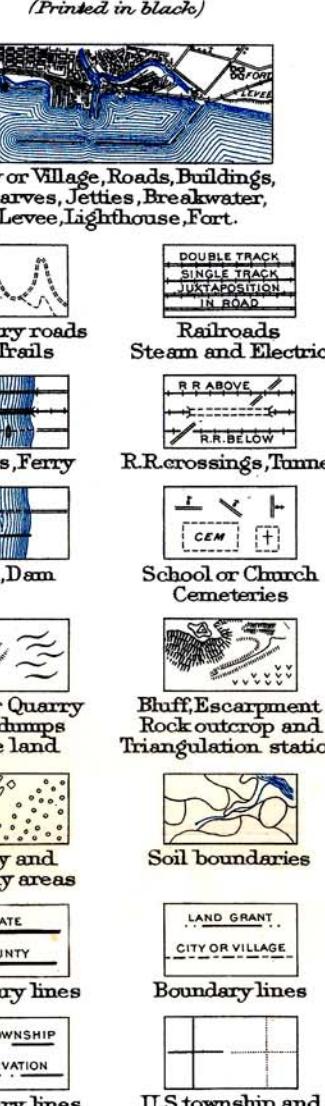
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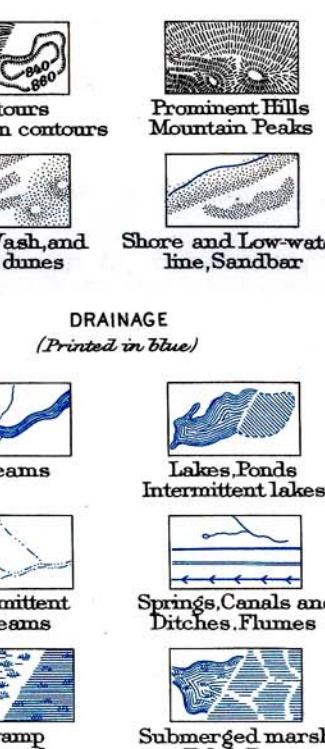


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